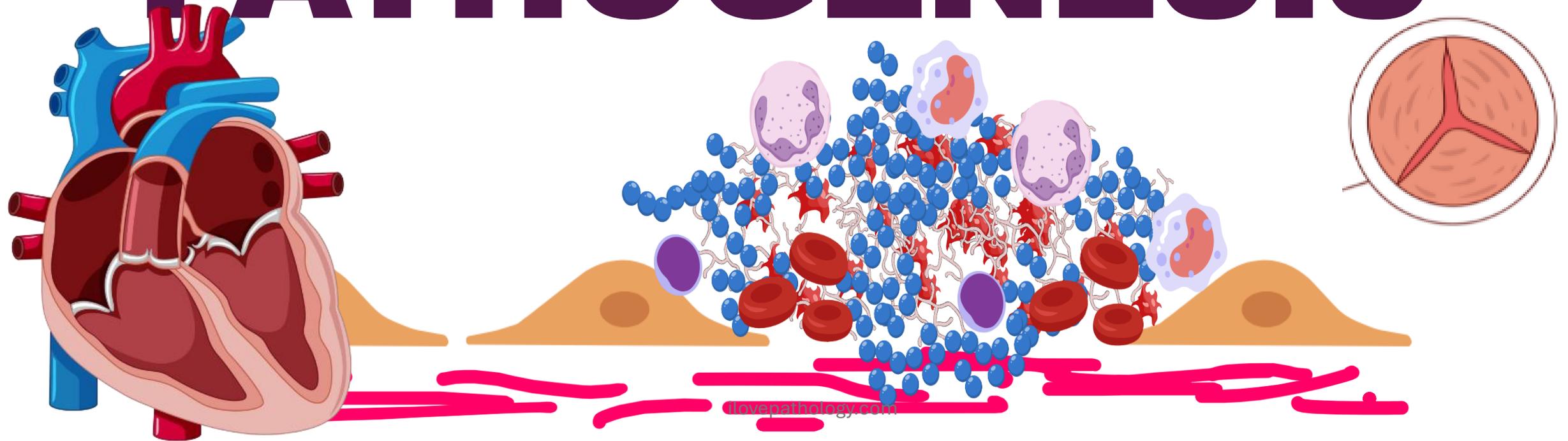




# INFECTIVE ENDOCARDITIS PATHOGENESIS





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WHY PATHOLOGY?

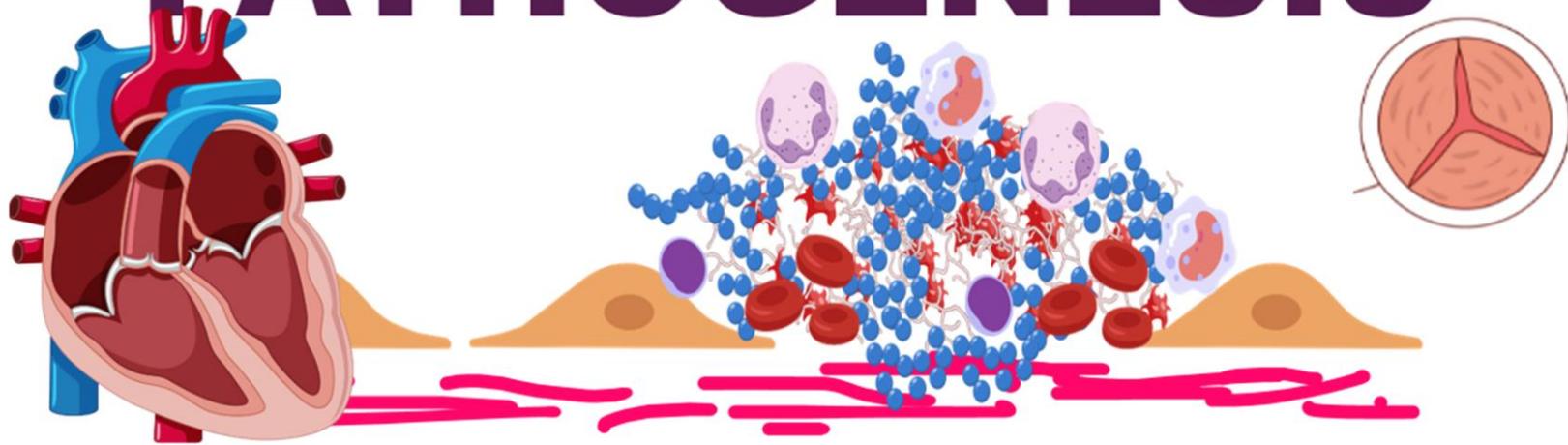
CATEGORIES
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ILOVEPATHOLOGY





# INFECTIVE ENDOCARDITIS PATHOGENESIS



# Overview

- Definition
- Risk factors
- Pathogenesis

# INFECTIVE ENDOCARDITIS

Microbial infection of the heart valves or the mural endocardium

That leads to the formation of **vegetations**

*Composed of thrombotic  
debris and organisms*

Often associated with destruction of the underlying cardiac tissues.

# EPIDEMIOLOGY

Majority of them are bacterial cause

Can be fungal or other microbial

# CLASSIFICATION

## ACUTE

Infection of a previously normal heart valve

By a *highly virulent* organism ***Staphylococcus aureus***

Rapidly Produces destructive lesions.

Antibiotics alone may not help!

Often require surgery

## SUB ACUTE

Insidious infections of Deformed valves

By a *low virulent* organism ***viridans streptococci***

Less destruction

cures can often be achieved with antibiotics alone.

***Most cases fall along the spectrum in between these two forms***

# RISK FACTORS

## **Cardiac valvular abnormalities**

*Rheumatic heart disease,  
Mitral valve prolapse,  
Bicuspid aortic valves, and  
Calcific valvular stenosis*

*Prosthetic heart valves*

## **Host factors**

*Elderly  
Neutropenia,  
Immunodeficiency,  
Malignancy,  
Diabetes, pregnancy and  
Alcohol or intravenous drug use*

## **Transient bacteremia**

*Dental procedures,  
Urinary catheterization,  
gastrointestinal endoscopy  
And obstetric procedures.*

## Causative organisms

Staphylococcus

Streptococcus  
viridans,

Enterococci

Most  
common

## Causative organisms

### Staphylococcus

Streptococcus  
viridans,

Enterococci

Most Common cause of IE arising in healthcare settings and in intravenous drug users.

More virulent

Can attack healthy as well as deformed valves

Often presents as acute IE

**Most common cause of infective Endocarditis in most higher-income countries**

## Causative organisms

Staphylococcus

**Streptococcus  
viridans,**

Enterococci

In community-acquired IE, 50% to 60% of cases are by SV

Less virulent

Can attack healthy as well as deformed valves

Often presents as subacute IE

## Causative organisms

Staphylococcus

Streptococcus  
viridans,

Enterococci

Most  
common

Gram negative  
bacilli and fungi

Very rare

## Other group

“**HACEK** group

*Haemophilus*,  
*Actinobacillus*,  
*Cardiobacterium*,  
*Eikenella*, and  
*Kingella*

Oral cavity  
commensals

**10% of cases No cause!**

# PATHOGENESIS OF INFECTIVE ENDOCARDITIS

Endothelial  
damage

Pathogen access  
to bloodstream

Pathogen  
adherence

Pathogen  
proliferation

# PATHOGENESIS OF INFECTIVE ENDOCARDITIS

## Endothelial damage

Normal endothelium is resistant to infection unless the organism is highly virulent. Eg..S Aureus

### Causes :

Turbulent blood flow (e.g., around abnormal or prosthetic valves)

Autoantibodies (e.g., in autoimmune disease)

Inflammatory injury (e.g., rheumatic carditis)

Direct insult

Pathogen access  
to bloodstream

Pathogen  
adherence

Pathogen  
proliferation

# PATHOGENESIS OF INFECTIVE ENDOCARDITIS

## Endothelial damage

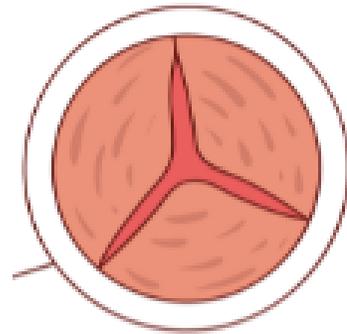
Pathogen access to bloodstream

Pathogen adherence

Pathogen proliferation

## Where damage is most likely seen?

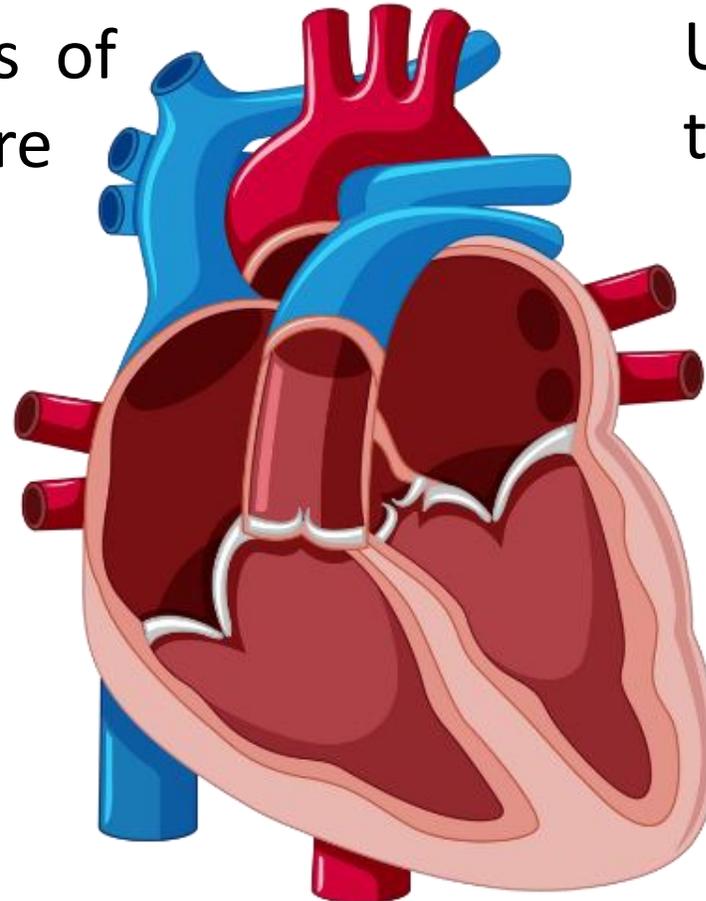
Points of closure



Upstream face of the valve

*the side facing the incoming jet of blood causing high-velocity, turbulent flow*

**Atrial Side Of**  
Atrioventricular Valves  
**Ventricular Side Of**  
Semilunar Valves



# PATHOGENESIS OF INFECTIVE ENDOCARDITIS

**Endothelial  
damage**

Pathogen access  
to bloodstream

Pathogen  
adherence

Pathogen  
proliferation

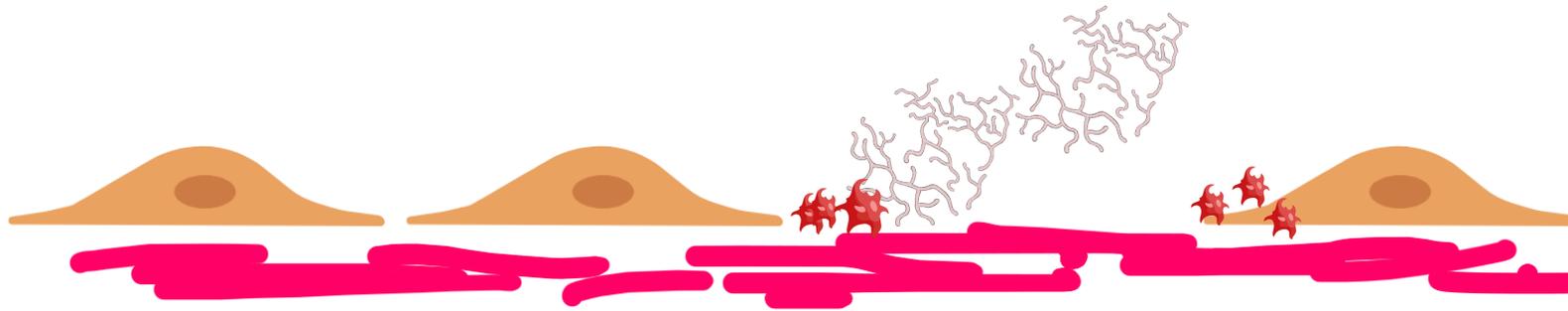
**What happens when the  
endothelium is damaged?**



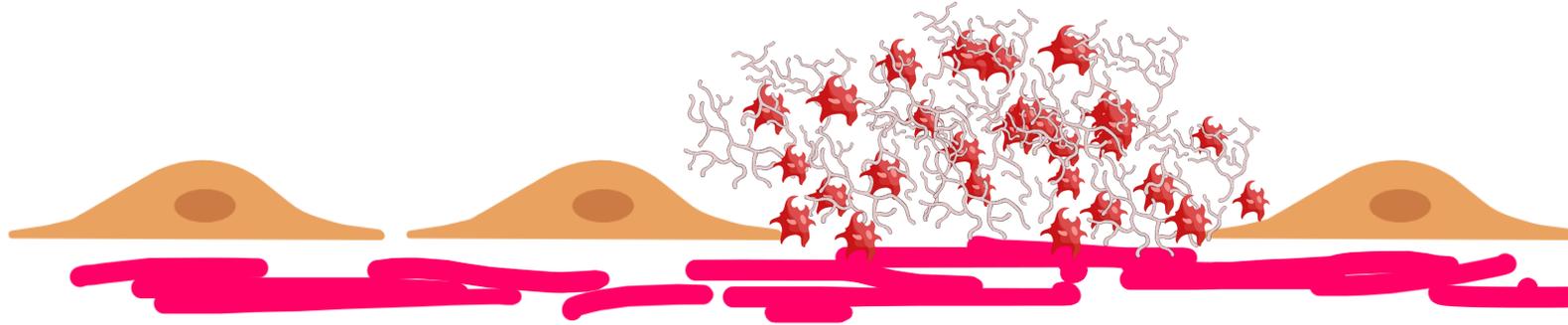




Exposes subendothelial matrix.



Triggers platelet aggregation and fibrin deposition.



Creates a sterile thrombus

***NIDUS***  
*for microbial colonization*

# PATHOGENESIS OF INFECTIVE ENDOCARDITIS

## Endothelial damage

Pathogen access to bloodstream

Pathogen adherence

Pathogen proliferation

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# PATHOGENESIS OF INFECTIVE ENDOCARDITIS

Endothelial  
damage

Bloodstream is normally sterile

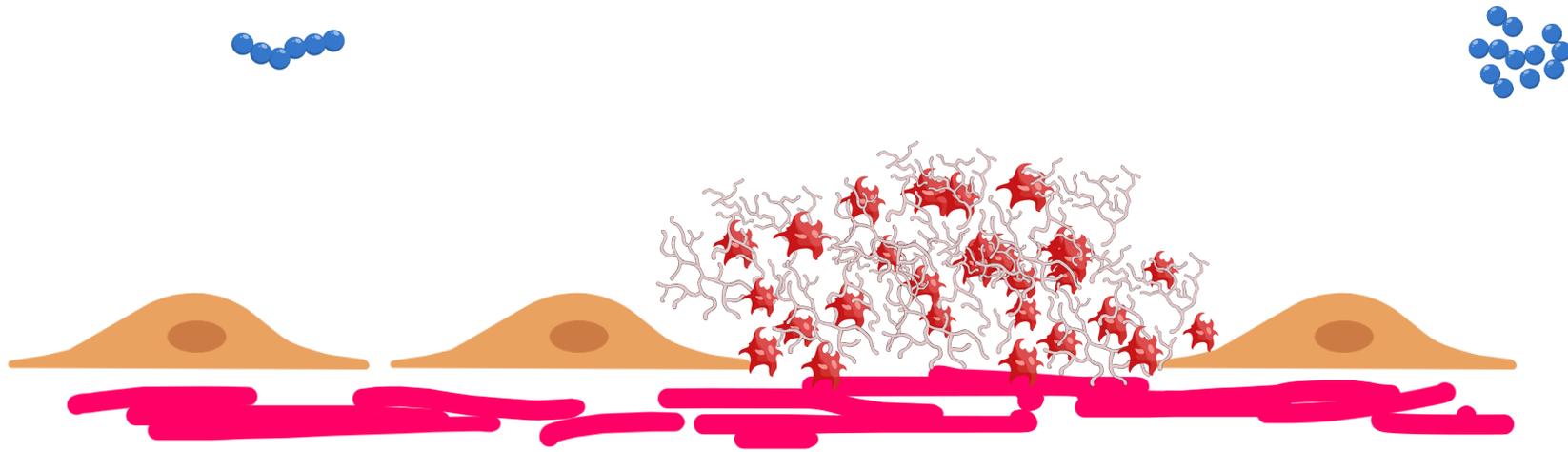
**Pathogen access  
to bloodstream**

*Dental procedures,  
Urinary catheterization, gastrointestinal  
endoscopy  
And obstetric procedures.*

Bacteremia

Pathogen  
adherence

Pathogen  
proliferation



# PATHOGENESIS OF INFECTIVE ENDOCARDITIS

Endothelial  
damage

Adhere to the damaged valve or the sterile thrombus.

Pathogen access  
to bloodstream

## Facilitating factors for adhesion

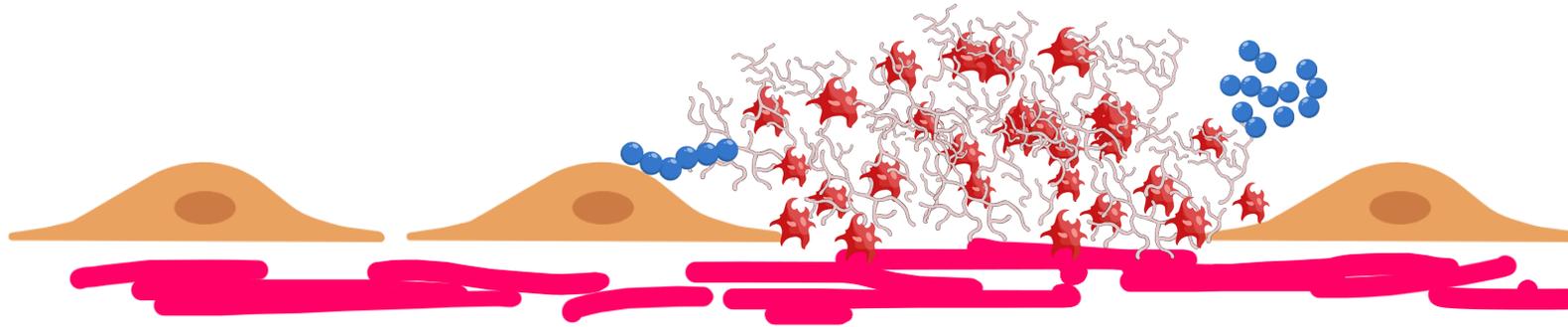
Endothelial activation → **upregulation of VCAM-1, ICAM-1, E-selectin**

**Pathogen  
adherence**

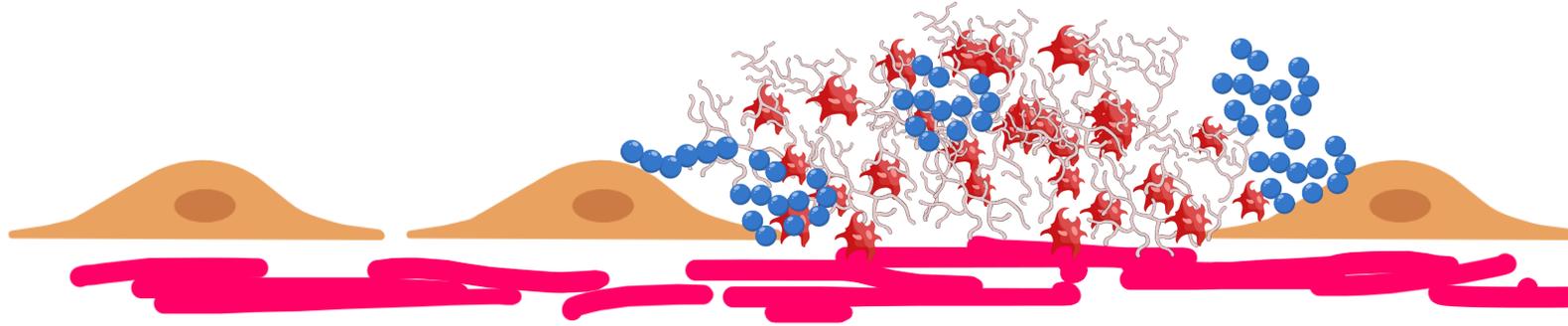
Bacteria bind to fibronectin ( from the host) through fibronectin binding proteins

Pathogen  
proliferation

Some bacteria have extracellular polysaccharides that help in sticking.

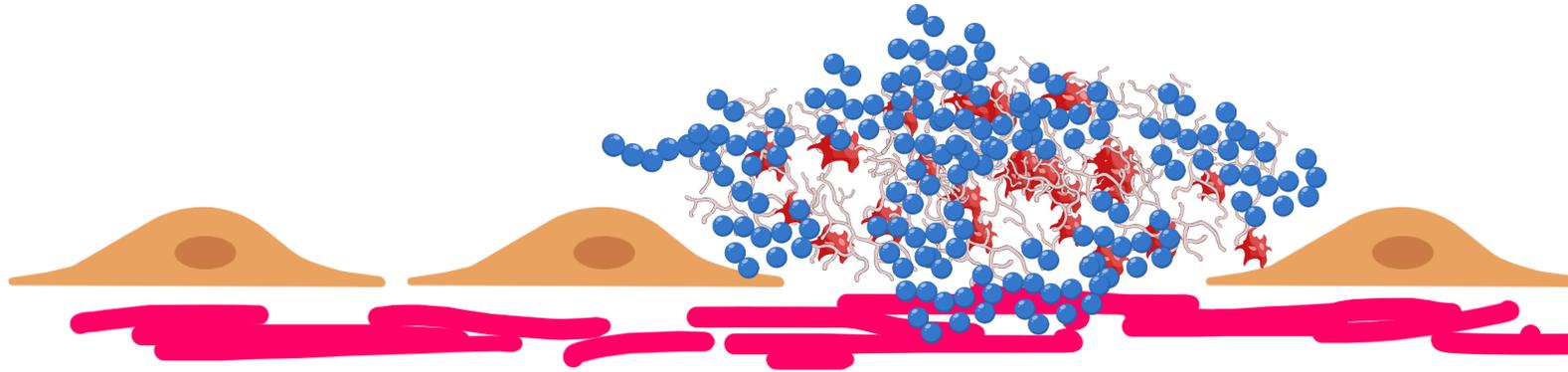


# PATHOGENESIS OF INFECTIVE ENDOCARDITIS



Attached bacteria proliferate within the thrombus,

# PATHOGENESIS OF INFECTIVE ENDOCARDITIS



Attached bacteria proliferate within the thrombus,

# PATHOGENESIS OF ISCHEMIC HEART DISEASE

Endothelial  
damage

Pathogen access  
to bloodstream

Pathogen  
adherence

Attached bacteria proliferate within the thrombus,

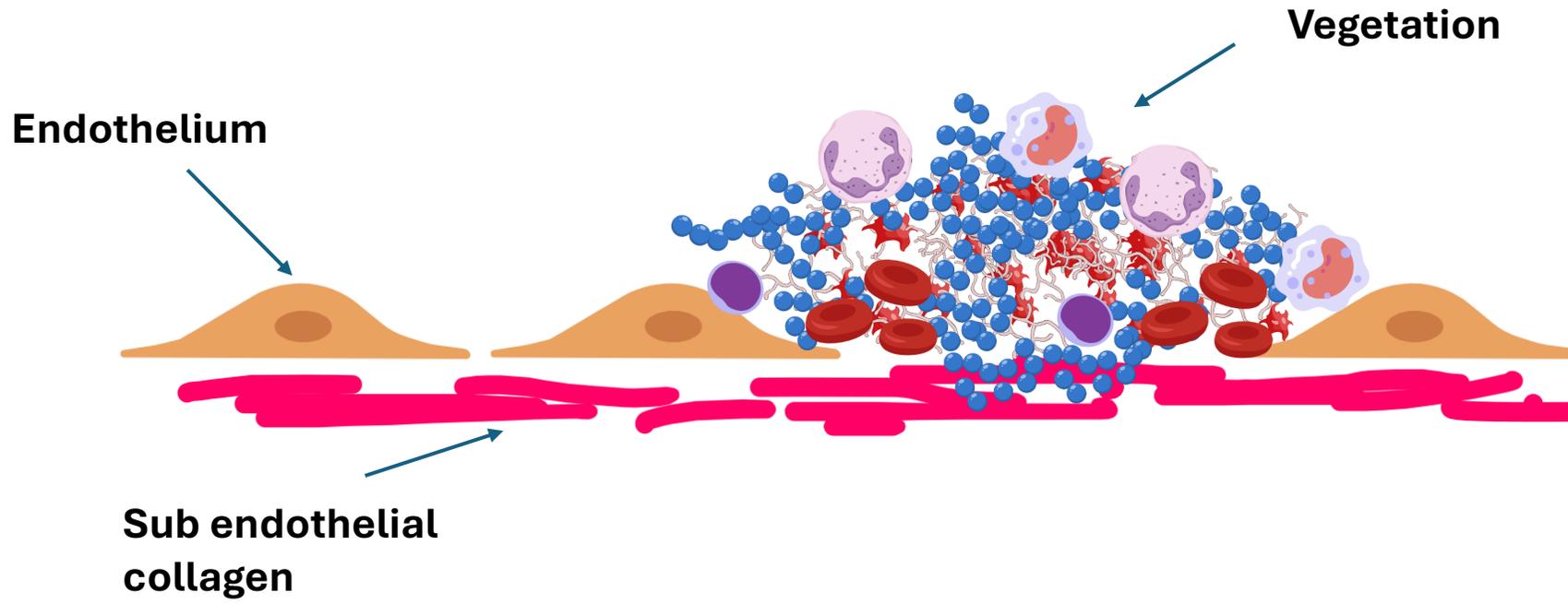


## **Vegetations**

*Layers of platelets, fibrin,  
leukocytes, red blood cells*

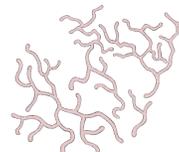
*Bacterial colonies embedded  
within*

**Pathogen  
proliferation**

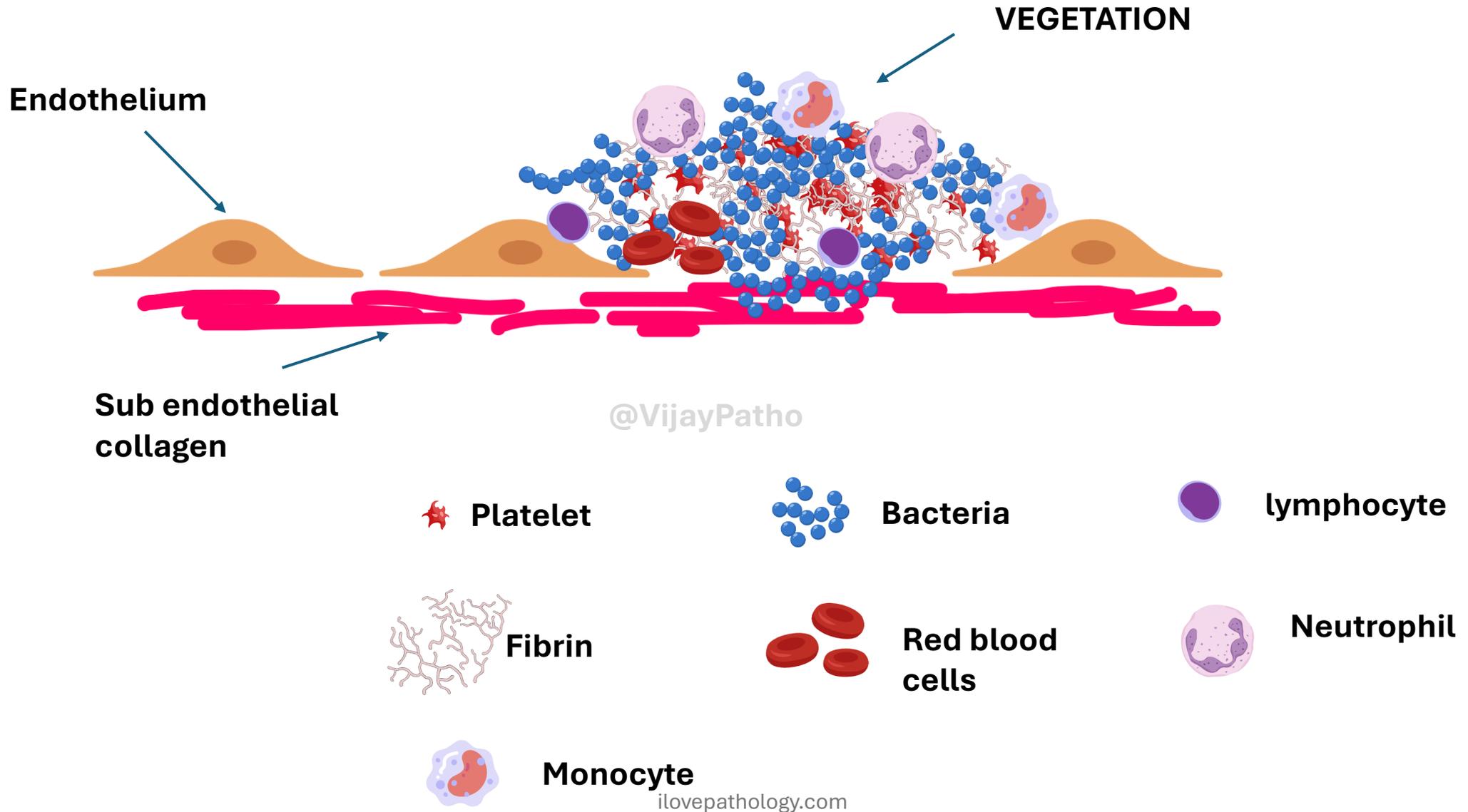


 Platelet

 Bacteria

 Fibrin

# PATHOGENESIS OF INFECTIVE ENDOCARDITIS



# PATHOGENESIS OF ISCHEMIC HEART DISEASE

Endothelial damage

Pathogen access to bloodstream

Pathogen adherence

Attached bacteria proliferate within the thrombus,

**Vegetations**

*Layers of platelets, fibrin, leukocytes, red blood cells*

*Bacterial colonies embedded within*

Spread locally

Septic emboli

Destruction and perforation

Regurgitation

**Pathogen proliferation**

Predisposing factors



Endothelial damage



Exposure of sub endothelium



## PATHOGENESIS OF ISCHEMIC HEART DISEASE

Sterile thrombi with fibrin



Thrombi +fibrin+ bacterial proliferation



**ENDOCARDITIS**

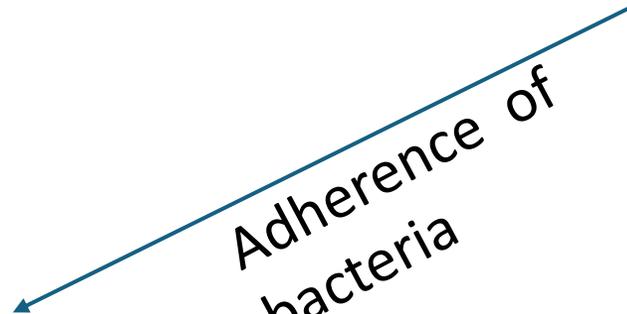
**VEGETATIONS**

Sources of bacteria



Bacteriemia

Adherence of bacteria



# Summary

- Definition
- Risk factors
- Pathogenesis

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